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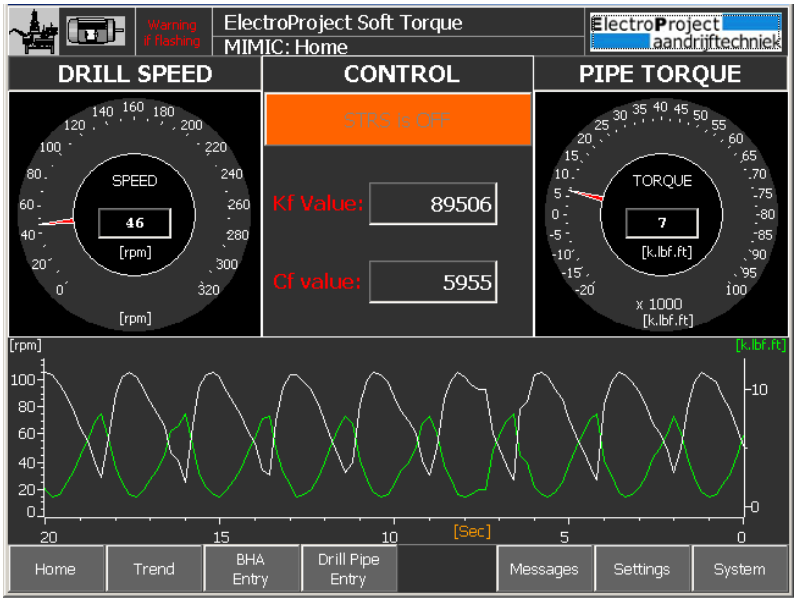
Electroproject Soft Torque

Operation manual V3.0



Revision History

Rev.	Date	Description	Applicable from software version
2.1	01-oct-2009	Hans Deul & Roger Lewis version	EPST V1.060 / HMI V1.3
3.0	12-April-2010	Update mimics & DPE screen	EPST V1.072 / HMI V1.4

Safety Guidelines

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol; notices referring only to property damage have no safety alert symbol.

Qualified Personnel

The device/system may only be set up and used in conjunction with this documentation. Commissioning and operation of a device/system may only be performed by qualified personnel. Within the context of the safety notes in this documentation qualified persons are defined as persons who are authorized to commission, ground and label devices, systems and circuits in accordance with established safety practices and standards.

Prescribed Usage

Note the following:

WARNING

The EPST system may only be used for the applications described in this manual and only in connection with devices or components from other manufacturers which have been approved or recommended by Electroproject. Correct, reliable operation of the product requires proper transport, storage, positioning and assembly as well as careful operation and maintenance.

When devices or components from other manufacturers, which have been approved or recommended by Electroproject and which are connected with the EPST system, changes due to hardware or software updates possible malfunction of the system arise.

IMPORTANT

The EPST system will become RIG specific after commissioning.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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1. Preface

1.1. Purpose of this manual

This operation manual is part of the Electroproject Soft Torque (EPST) documentation.

The manual provides information and guidelines for the operation of the EPST system.

The manual is intended for drillers and engineers operating the EPST system.

1.2. Basic Knowledge Requirements

General knowledge in the field of drilling installations, electrical installations and automation engineering is required to understand this manual.

Off-shore installations

Additional knowledge in the field of off-shore electrical installations and requirements are needed.

Explosion Proof- installations

Additional knowledge in the field of off-shore installations and requirements are needed.

1.3. Position in the information scheme

This manual is part of the Electroproject Soft Torque (EPST) documentation. The information below presents an overview of the information landscape of EPST system.

- Technical request form.
  Provides needed technical data from top-drive system to start engineering of EPST system.

- Installation and mounting instructions.
  Provides guidelines for the installation and erection of EPST system.

- Installation Rig System On Paper (IRSOP) procedure.
  Provides guidelines for the commissioning and start up of EPST system.

- **Operation manual.**
- **Quick reference guide to EPST touch screen**

We trust that following these instructions, the EPST system will positively contribute to your operating results for many years to come.

We will be pleased to supply you with further information and assistance as regards installation of your EPST system.

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2. Stick-Slip mitigation

2.1. What is “Stick-Slip”?

“Stick-slip” is a common occurrence in drilling operations that can result in harmful rotational vibrations in the drill-string. Although the drill-string is continuously rotating at surface during the drilling operation, friction on the bit, bottom hole assembly (BHA) and/or drill-string itself can cause it to “stick” down hole. As rotation at surface continues and torque in the drill-string builds up, this ‘stick’ friction is suddenly overcome causing a sudden increase in speed ("slip") as the drill-string 'unwinds' itself. When fully developed, stick-slip can cause the bit and BHA rotation to completely stop and accelerate up to 5-6 times the surface r.p.m.

“Stick-slip” can cause:

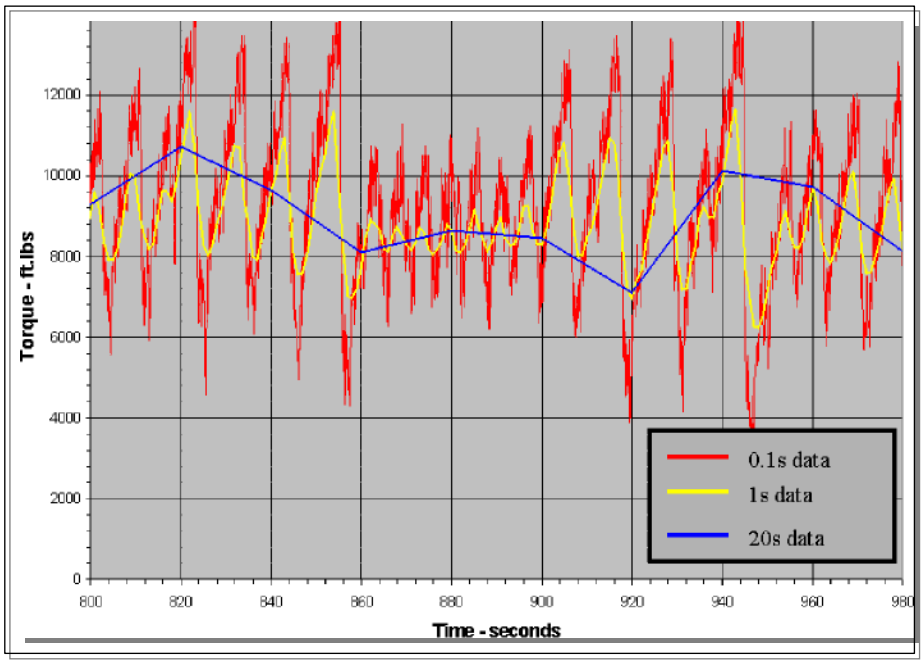
- **damage to the bit;**
- **broken cutters;**
- **decreased rate of penetration (ROP)**
- **decreased bit life.**

Furthermore, it can also damage other down hole components such as rotary steerable systems, and Measurement While Drilling devices (MWD). It can even cause down-hole motors to stall.

2.2. Recognizing when “Stick-Slip” is occurring

There are two clear stick-slip indicators for the driller:

1. **Large variations in surface torque.**
2. **Large variations in downhole RPM.**



The torque variations can be accompanied by “groaning” noise coming from the top drive. Characteristic for the slip-stick behaviour is the saw-tooth behaviour of the torque, which can go up to 50% torque variation. In Figure 1 is an example of the characteristic saw-tooth torque variations. This behaviour can only be seen clearly when using data with at least 1-second sample time.

Figure 1: Torque variations due to stick-slip

2.3. How to reduce “Stick-slip”

Stick-Slip only occurs at a rotary speed below a certain threshold value. The threshold value depends on system parameters such as design of the drill-string, mud, bit, BHA and weight on bit (WOB). The driller can reduce stick-slip by:

1. Increasing the rotary speed (RPM);
2. Reducing the weight on bit (WOB);
3. Add lubricants to the mud system;
4. **Install Electroproject soft torque system (EPST) to reduce Stick slip.**

Please note that EPST, is the first soft torque system specifically developed for AC top drives and modern DC drives. Soft Torque technology has been in use since the early ‘90’s.

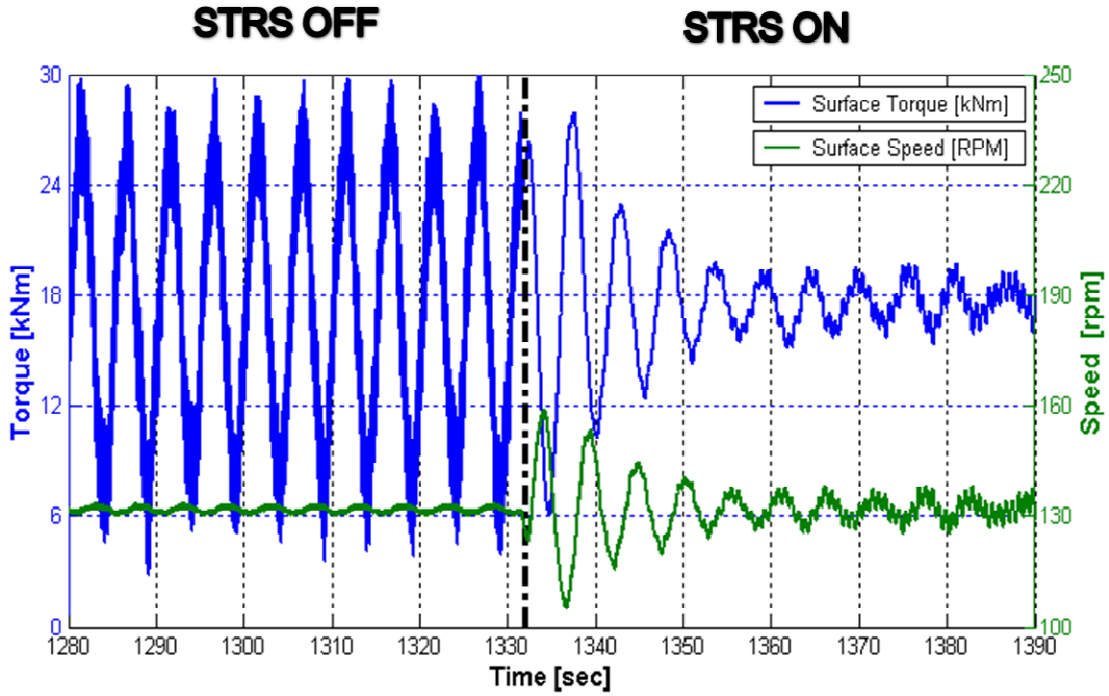


Figure 2: Activating soft torque

In Figure 2 at 1332 seconds soft torque is switched on. Torque becomes smoother and speed variations are greater. This is typical when soft torque is active.

3. General

3.1. System overview

The EPST system is designed to be easily implemented in modern drive systems.
The EPST controller is a standalone but RIG specific µ-processor based controller. It can operate without any interface with the RIG-controls.

To implement the system the following hardware is required (see figure 3):

1. Touch panel to operate the system.
2. Industrial PC (IPC). The Soft Torque controller.
3. Additional PROFIBUS communication interface with variable frequency drive (VFD)
4. Ethernet communication between touch panel and IPC
5. If not already present, speed encoder at TOP DRIVE motor.

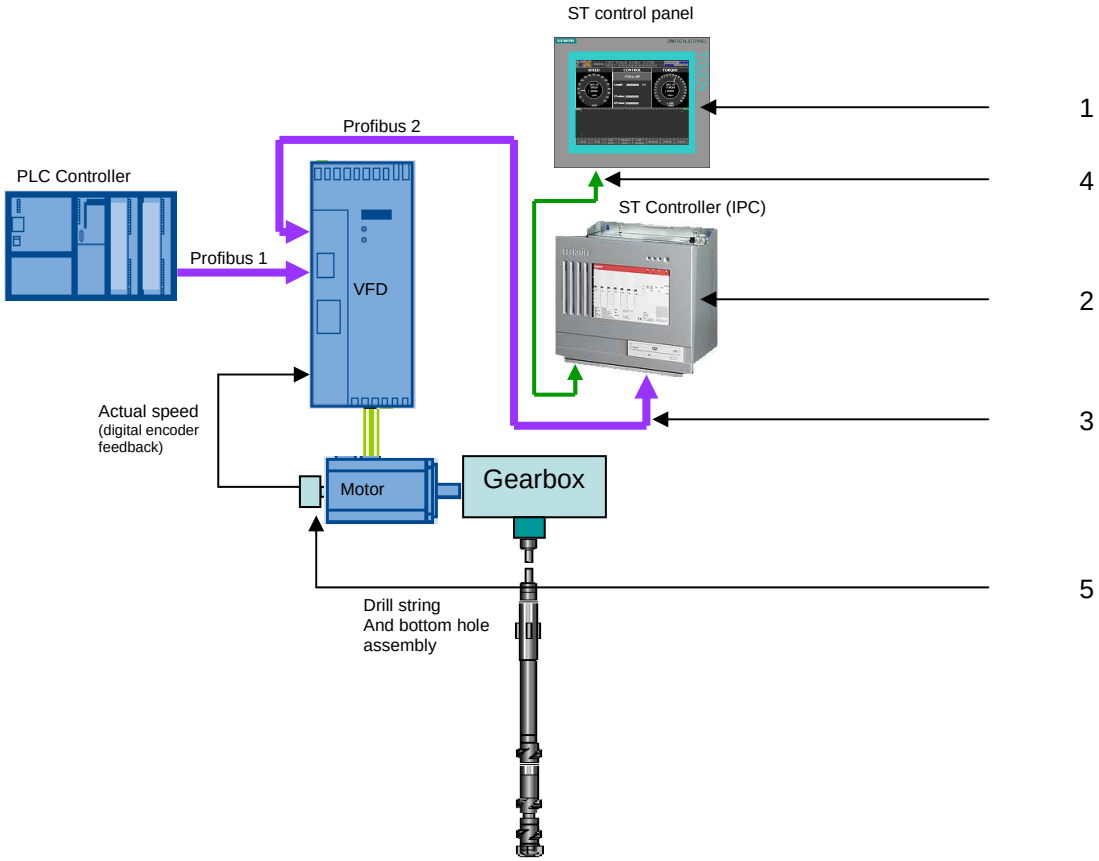


Figure 3: EPST System overview

To make the controller work properly a fast connection between VFD and EPST controller is necessarily. In the block diagram above this fast connection has been made with a second profibus interface to the VFD.

3.2. EPST control and input

With the touch panel the EPST controller can be operated and speed and torque variables can be monitored.

The EPST controls consist of:

1. Switching Soft Torque (ST) ON and OFF.
2. Entering the right settings for the tuning parameters Kf and Cf.
3. Alternatively calculation of Kf and Cf depending on BHA and Drill pipe specifications

3.3. Settings

The system has: **user settings** and **system settings**. The user settings (not protected by password) can be found at the "**Settings" screen**. System settings can be found at the **"System" screen** which is password protected. The system screen is only for "EPST specialists".

IMPORTANT
The EPST system can only be used after been commissioned by an Electroproject EPST specialist.

3.4. Speed and torque monitoring

On the touch panel, actual values of speed and torque can be monitored in real-time.
These values can also be monitored graphically in a trend display of 100 seconds.

An adjustable filter time for all display values can be set in the settings screen to avoid aliasing of the sampled trend due to the communication speed between the touch panel and the EPST controller.

3.5. Advanced data logging

The EPST controller is programmed in an IPC (Industrial PC). The operating system is Linux.
The IPC also functions as a data server for logging purposes, the EPST-server.

The EPST-server, stores the actual values of all inputs, outputs, variables, markers and parameters to hard disk. When the VFD is operating, the resolution of this log data is 5ms. Depending on the size of the applied hard disk(s), log data can be hold for months.

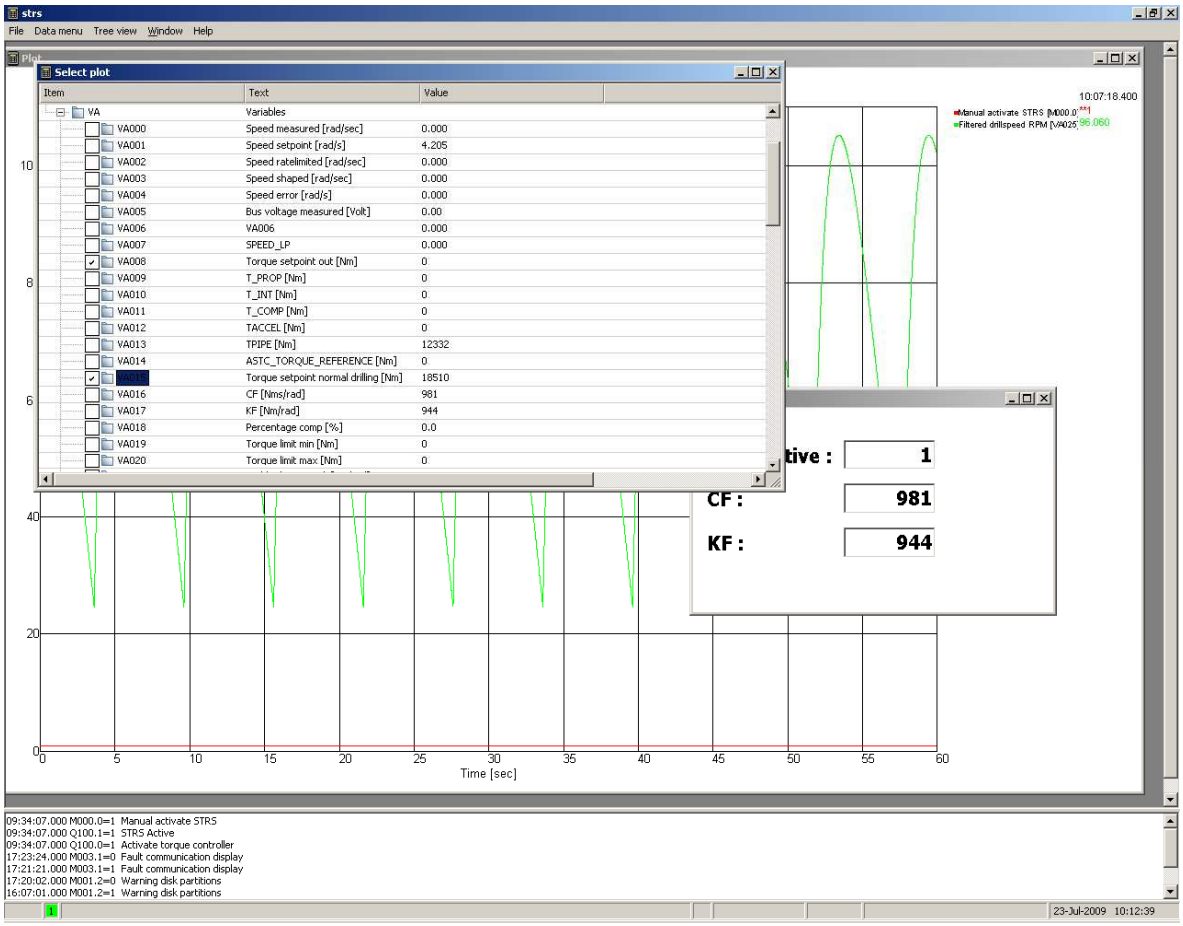

strs
File Data menu Tree view Window Help
Select plot
Item Text Value
VA Variables
VA000 Speed measured [rad/sec] 0.000
VA001 Speed setpoint [rad/s] 4.205
VA002 Speed ratelimited [rad/sec] 0.000
VA003 Speed shaped [rad/sec] 0.000
VA004 Speed error [rad/s] 0.000
VA005 Bus voltage measured [Volt] 0.00
VA006 VA006 0.000
VA007 SPEED_LP 0.000
VA008 Torque setpoint out [Nm] 0
VA009 T_PROP [Nm] 0
VA010 T_INT [Nm] 0
VA011 T_COMP [Nm] 0
VA012 TACCEL [Nm] 0
VA013 TPIPE [Nm] 12332
VA014 ASTC_TORQUE_REFERENCE [Nm] 0
Torque setpoint normal drilling [Nm] 18510
VA016 CF [Nms/rad] 981
VA017 KF [Nm/rad] 944
VA018 Percentage comp [%] 0.0
VA019 Torque limit min [Nm] 0
VA020 Torque limit max [Nm] 0
10:07:18.400
Manual activate STRS [M000.0:**1
Filtered drillspeed RPM [VA025:96.060
tive : 1
CF : 981
KF : 944
Time [sec]
09:34:07.000 M000.0=1 Manual activate STRS
09:34:07.000 Q100.1=1 STRS Active
09:34:07.000 Q100.0=1 Activate torque controller
17:23:24.000 M003.1=0 Fault communication display
17:21:21.000 M003.1=1 Fault communication display
17:20:02.000 M001.2=0 Warning disk partitions
16:07:01.000 M001.2=1 Warning disk partitions
23-Jul-2009 10:12:39

Figure 4: Screenshot ST log-data view program

The log data can be viewed, exported and analyzed with a special EPST data-log view program.
The EPST data-log viewer can be installed on a Windows based PC.

3.6. Remote access

If the IPC is connected to a WAN network, logdata and status of the IPC can be remotely accessed. Even remote assistance and updates are possible.

If a connection has to be made between the EPST network (IPC and touch panel) and another network, a specific TCP/IP setting has to be made. These settings can only be changed by Electroproject personal. The standard IPC TCP/IP configuration is stand alone but RIG specific with a DHCP server enabled.
Please contact us for other configurations.

3.7. EPST off-line

Since the EPST system is designed as a standalone but RIG specific controller the drill operation can continue if the EPST system is off-line.
Drill operation can continue with disconnected EPST system. If the EPST is turned off, the original control of the VFD is restored.

3.8. Unit system: metric or imperial.

The unit system can be changed in the “settings screen”

IMPORTANT
A common cause of problems with operation is wrong data input. Wrong data input can be caused by the wrong choice of unit system.

4. Kf and Cf tuning parameters

4.1. Principle of operation

An oil-rig's top-drive is a multi-purpose controllable high power drive. During drilling the drill-pipe is the intermediate between a drill and the top-drive. A practical problem is so called `stick-slip' while drilling. Experience shows that a relatively constant speed of the bit is optimal for effective penetration, low drill wear and good steering conditions.
At certain depths and depending on drilling conditions, among others: friction on bit, drill speed and weight on bit, the drill bit can “stick” down hole while the drillstring keeps rotating. The drill-pipe acts as a torsional spring. Since the Top Drive does not recognize the “stick” of the drill bit, the rotation of the drill pipe continuous and the drill-pipe will wind up. As a result the torque in the pipe builds up. At a certain torque value the “stick” friction is overcome and the drill-bit suddenly increase in speed while the drill pipe “unwinds” itself. The large speed variations can damage downhole components, including the bit itself. Furthermore, stick-slip is known to decrease ROP by some 25%. Also steering rotary drilling operation is very difficult under “stick-slip” conditions.

The EPST system is designed to mitigate the stick-slip behaviour. The EPST controller is a speed controller tuned with the *Kf* (drive stiffness in Nm/rad) and *Cf* (drive damping in Nms/rad) values. Depending on the drill string and BHA configuration the tuning parameters *Kf* and *Cf* are calculated. EPST will be able to improve damping of stick-slip when the two tuning parameters *Kf* and *Cf are* on target or not too far from ideal values. Also drill speed needs to be above a threshold value. Compared to normal operation (EPST is off) the threshold speed value above which stick-slip cannot exist, is lower when soft torque is on.

IMPORTANT
Kf and Cf must be adjusted each time the drill string configuration changes (e.g. adding a stand)!

There are two ways to specify Kf and Cf.

1. Manually input of Kf and Cf (Home screen)
2. Calculation with integrated BHA and drill string configuration.
   (BHA and Drill pipe entry screen)

4.1.1. Manual input of Kf and Cf

Manual input of Kf and Cf is always possible.
Entering the right settings must be done on the “Home” screen by touching Kf and Cf input fields.
If working with manual input of Kf and Cf a table must be provided with Kf and Cf values for each bit depth. This sheet is normally provided by SHELL.

4.1.2. Calculation with BHA and DP entry

Alternatively, the EPST controller can calculate the values of Kf and Cf.
For this calculation the configuring of the bottom hole assembly (BHA) and the drill string data has to be inputted in the EPST. The input of data and calculation is done on the “BHA-entry” and “Drill Pipe-entry” screen (for a detailed description see chapter 5.4 and 5.5).

The drill pipe entry screen does have a total of three different drill pipe parts to configure.
Item one is the lowest (connected to the BHA) and must be first selected.
A pipe part can be added by selecting a pipe name from the database and enter the TOTAL length of the stands.
Just adjust the length of the highest pipe part item (connected to the top drive) each time a connection has been made and then recalculate the Kf and Cf.

5. Screens of EPST touch panel

In this chapter all EPST screens will be described.

5.1. General for all screens

Functions available on all screens will be explained in this section.

Buttons

Buttons are operated by touching the displayed symbol on the screen

WARNING
Accidently touching the screen could activate unwanted functions. To wipe the screen clean see chapter 0 (Clean screen function)

Numeric input

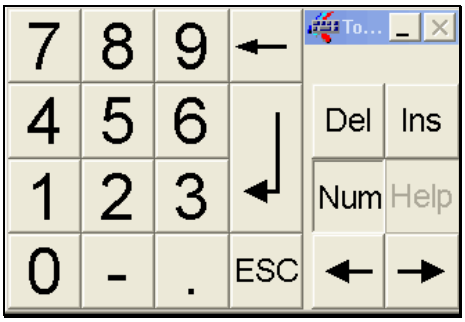


Figure 5: Numeric key-pad

0 – 9 = numeric input values
- =
‘ =
← = Backspace
↵ = Enter
ESC = Escape
Del = Delete
Ins = Insert
→ = move cursor to left
← = move cursor to right
Num = Toggle Numeric / Alphabetic keypad

The alphabetic keypad will not be described because no alphabetic input is required.

5.1.1. Bottom section of the screen

Depending on the version of the EPST control software and the available options, the below “screen selection buttons” will be present at the bottom section of each screen (see figure 6).

Figure 6: Bottom section of the screen

By selecting one of the screen selection buttons the selected screen will be activated.
The screens will be described in the next chapters.
The menu structure of the panel software is only one level except for the “System” screen.

5.1.2. Upper section of the screen

Figure 7: Upper section of the screen

Alarm signal and button:
If a warning is active the text “Warning if flashing” will be flashing.
By pressing the button, the warning screen will be opened. Active warnings will be displayed.
See paragraph 6.3

Actual mimic:
In the middle at the upper section of the template the name of the actual screen (mimic) is shown.

Info screen button:
By pressing on the “Electroproject Aandrijftechniek” logo the info screen of the EPST system is shown.
The info screen gives the Electroproject contact data and some background information of the EPST system

5.2. Home screen

This is the “start-up” screen.

On this screen an overview of the system is shown.
Gauges and trends with actual drill speed and pipe torque are shown.

Changing the display values from **metric** to **imperial** can be done at the “settings screen”.

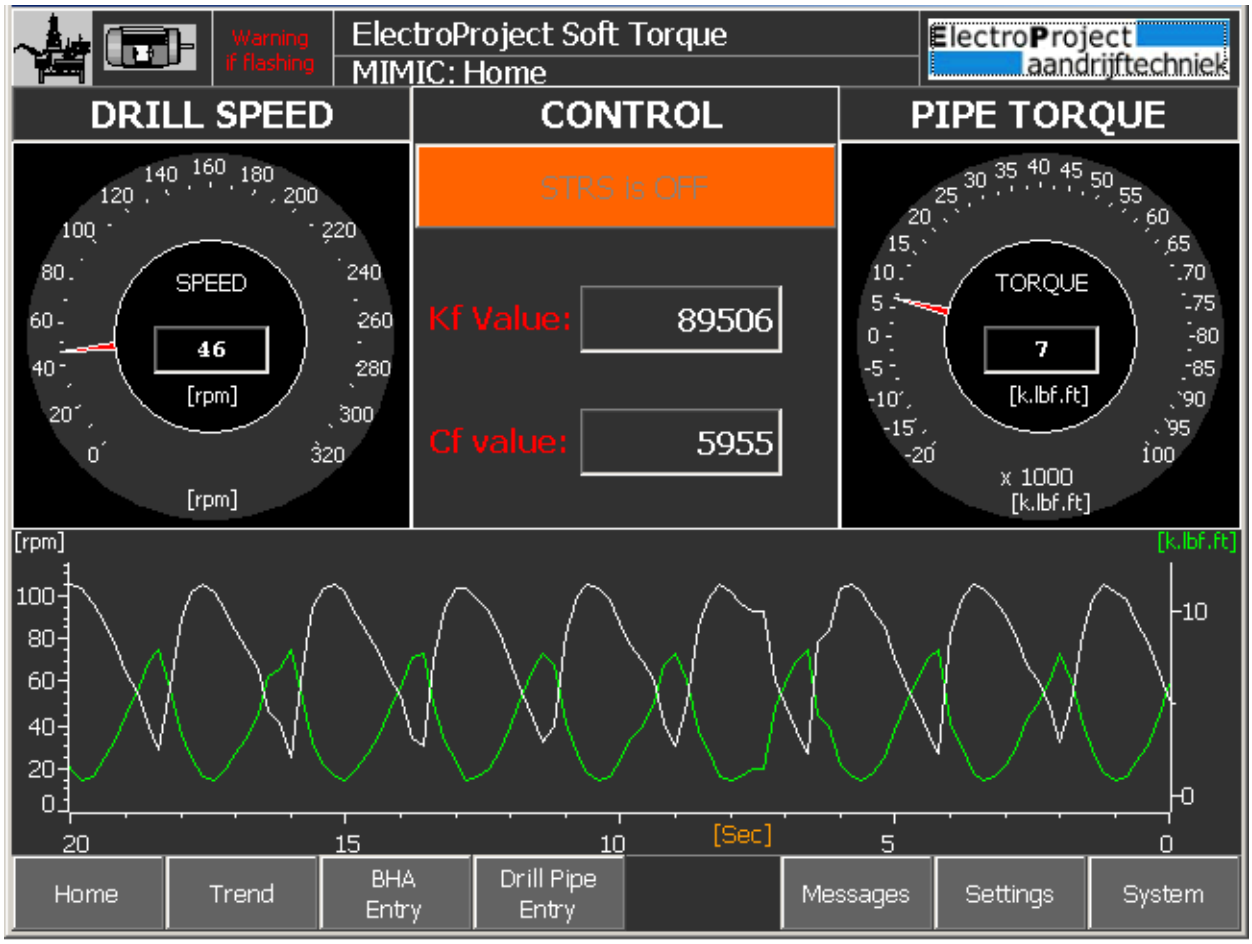


Figure 8: Home screen

CONTROL: ST ON/OFF

Switching ON and OFF is done by the “ST is ON/OFF” button (toggle function). The button flashes orange in OFF state and colours green in ON state.

Figure 9: ST button "OFF state"

If pressed “ST is OFF” ST will be switched **ON**.

Figure 10: ST button "ON state"

If pressed “ST is ON” ST will be switched **OFF**.

Switching ON the EPST controller can be done “bumpless” while the top drive is running.
If the EPST controller is switched OFF the original speed controller of the variable frequency drive (VFD) become active again.

IMPORTANT
Make sure that the right values of Kf and Cf have been set. This can be done manually, as explain below (CONTROL: Kf and Cf manual input) or calculated see paragraph 5.4 and 5.5.

ST will be **switched OFF automatically** when:

- a communication error occurs between IPC and VFD;
- communication timeout between touch panel and IPC has been exceeded;
  See chapter 0 “EPST-time-out display”
- the VFD speed setpoint is negative for a time longer then the “auto switch off time”.
  See chapter 0 “Auto switch off EPST”.

CONTROL: Kf and Cf manual input

To make the EPST controller work properly the right Kf and Cf parameters must be entered depending on bottom hole and drill string assembly configuration.
This can be done by touching the input fields of Kf and Cf on the main screen and **must be repeated after every stand.**
For input of Kf and Cf a data sheet must be available with the pre-calculated Kf and Cf values.
Normally provided by SHELL.

IMPORTANT

Soft Torque must be in the off state before changing the Kf and Cf parameters.

Kf and Cf values must be adjusted during drilling according to the drill depth to make the EPST controller work properly. Wrong settings can cause instability of the system.

Ask for new data sheet if drill string or BHA configuration is changed.

Example part of Kf and Cf sheet as provided by Shell:

Total Measured Depth (along hole)	**Tuned values**	
Total MD	**Kf**	**Cf**
m	**Nm/rad**	**Nms/rad**
1800	6188	2523
1829	6046	2508
1857	5909	2493
1886	5776	2478
1914	5649	2464
1943	5525	2449
1971	5406	2435
2000	5290	2422
2028	5178	2408
2057	5070	2395
2085	4965	2382
2114	4863	2369

This table is unique for each drill string and BHA.

5.2.1. Procedure manual input Kf and Cf

1. Check if correct Kf and Cf table is available for the current configuration.
2. Select Home screen.
3. Switch soft torque off (orange button should flash).
4. Select Kf input field (press at the current Kf numeric field).
5. Numeric keypad will appear.
6. Depending on total measured depth (MD) fill in the right Kf value (see example).
7. Before pressing enter button check if the entered value at the Kf field is correct.
8. Confirm value by pressing enter button.
9. Enter the new Cf value, same procedure as Kf (step 4 to 8).
10. EPST system is now ready to be started.

Example for selecting Kf and Cf values

A new stand is inserted.
Current total MD = 1975 meter.
The next total MD in the provided table is 2000 meter.
The corresponding values of Kf and Cf in the provided table are Kf = 5290 and Cf = 2422.
Enter these values in the corresponding input fields at the “Home” screen.
Before switching ST on again, check if values on the touch panel are correctly entered.

Speed meter

The speed meter gives the value for the actual drill speed of the TOP DRIVE (TD)

Torque meter

The torque meter gives the value for the actual pipe torque applied at drill pipe.

Trend display

The trend display shows the time related graph of drill speed and torque.

For a better indication of speed and torque choose the TREND display.
See chapter 0

The time scale (x-axis) is fixed. The graph shows the last 100 seconds.

The trend display does have “auto scaling” of Y values.
The scaling is only adjusted when the signals does not “fit”.

The scaling can be reset on the “Trend screen”.
See chapter 0

5.3. Trend screen

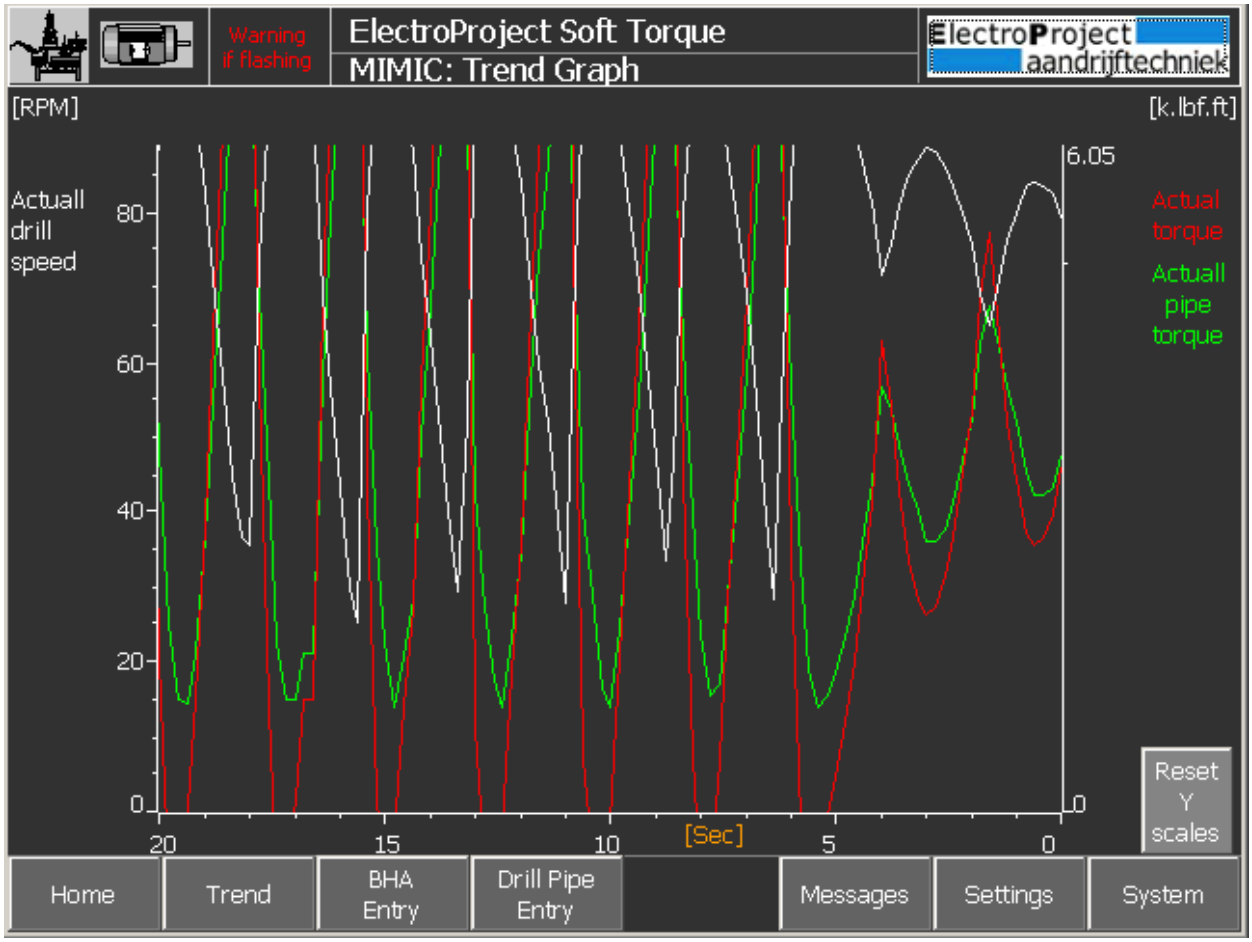


Figure 11: Trend screen

The trend graph shows three magnitudes:

1. Drill speed at TD

   n(drill speed at TD) = n(motor) / gear ratio

2. Actual applied torque.

   T (TD) = T (motor) * gear ratio

3. Actual pipe torque.

   Calculated pipe torque from EPST algorithm.

The trend graph of torque and speed has “auto scaling” of Y values. The scaling is automatically adjusted when the signals are out of range. The scaling can be reset by pressing the “Reset Y Scales” button.

The values are read from the EPST server every 0,5 seconds. To avoid a wrong interpretation of the signals (aliasing), a filter time for the displayed signals can be set at the “Settings screen”.
A value of > 0.75 seconds is recommended.

5.4. Bottom Hole assembly screen

Alternative to the manual input of KF and Cf, the EPST controller can also calculate the values of Kf and Cf. For this calculation the configuring of the bottom hole assembly (BHA) and the drill string data has to be inputted to the system. The input of data and the calculation of the tuning parameters is done on the “BHA-entry” and “Drill Pipe-entry” screen (see chapter 5.5).

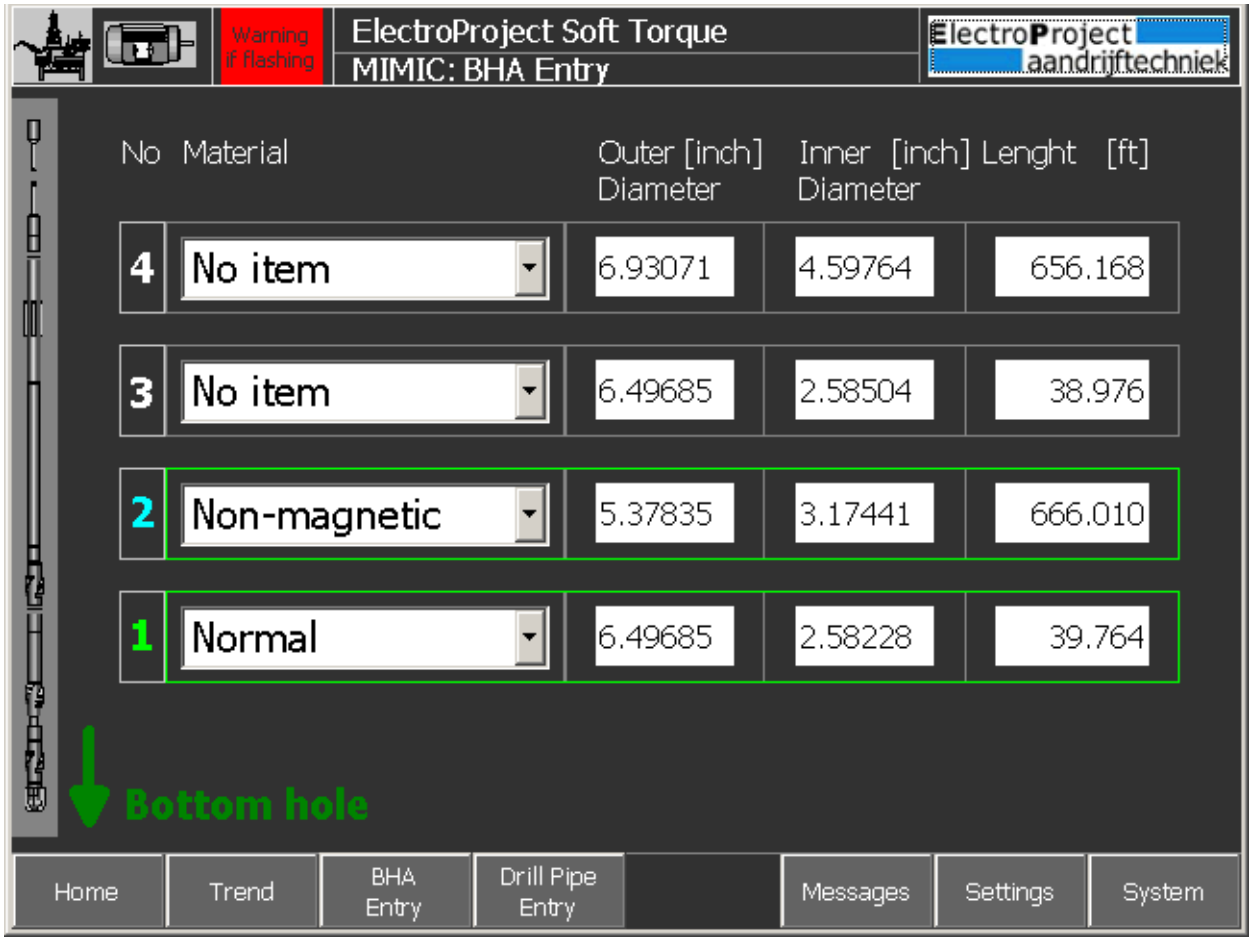


Figure 12: BHA Entry screen

The BHA entry screen has a maximum of four items to enter.
Obviously, in practice, a BHA will have more components. The most significant components in the BHA, in terms of weigth and length, **MUST** be entered; such as HWDP and / or DC. The length of smaller components, like the bit, motor, stabilizers, MWD and jars have to added to the main components in the BHA when using the BHA entry screen.
For each item four parameters should be entered:

1. Material. → “No Item”, “Normal” or “Non-magnetic”
2. Outer diameter.
3. Inner diameter.
4. Length.

The outer, inner-diameter and length can be entered by selecting it’s numeric input field. Because of the huge variety of BHA components there is no database of components implemented in the EPST system. By lumping the BHA into four major items the BHA entry can be simple and it is not necessary to maintain a large data base. The BHA items must be entered from the bit up! Item one is closest to the bit! Unused items will not be included in the calculations. It is recommended to always use the four available items to input the BHA, to make the tuning as accurate as possible.

Material:

The settings for material are:

1. Normal.
2. Non-magnetic.
3. No-Item.
   If “No item” is selected as material this item will not be part of the calculation of Kf and Cf.

Outer diameter, inner diameter, Length:

Fill in the sizes of the configured BHA items.
Note: The unit system can be changed in the “settings screen”.

BHA Calculations:

The calculation of Kf and Cf can only be started after the drill pipe has been configured at the “Drill Pipe Entry” screen.

IMPORTANT
Once drilling has started with a certain BHA configuration, the entries on this BHA entry screen don’t have to be adjusted anymore.

5.5. Drill Pipe Entry screen

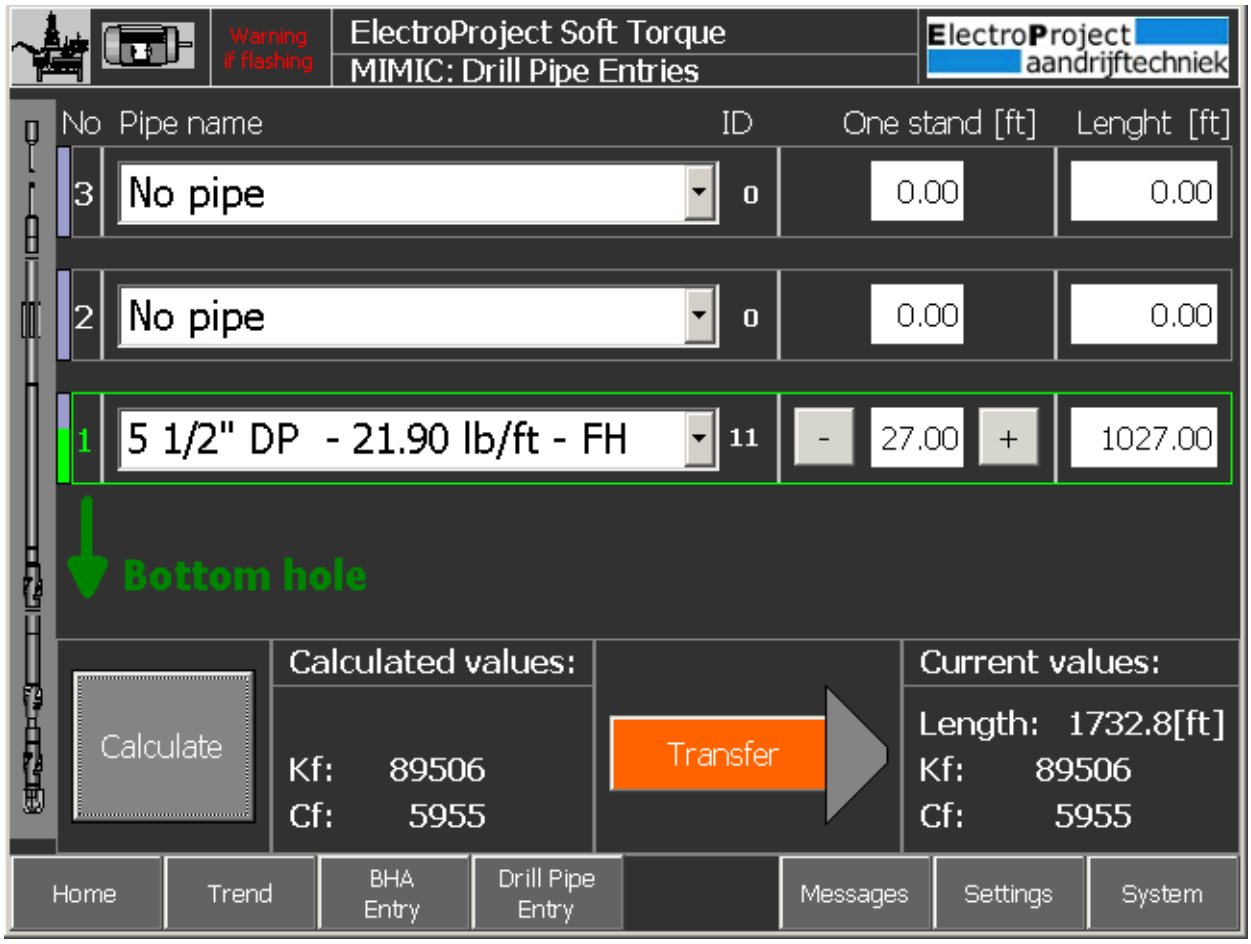


Figure 13: Drill Pipe Entry screen

The drill pipe entry screen does have a total of three different drill pipe sections to configure.

Item 1 is the lowest (connected to the BHA) and must be entered first. In case this drill pipe section runs all the way to surface, items 2 and 3 will remain unused.

Pipe name and ID field:

There are currently 14 different pipe choices available.
Select one of the pipes from the pull-down menu at each pipe name field, corresponding or closest to your DP specification.

Currently available pipes:

Pipe number	Pipe name
1	3 1/2" DP - 9.50 lb/ft - NC38
2	3 1/2" DP - 13.30 lb/ft - NC38
3	3 1/2" DP - 15.50 lb/ft - NC38
4	4" DP - 11.85 lb/ft - NC46
5	4" DP - 14.00 lb/ft - NC40 (FH)
6	4 1/2" DP - 13.75 lb/ft - NC50
7	4 1/2" DP - 16.6 lb/ft - NC50
8	4 1/2" DP - 20.00 lb/ft - NC50
9	5" DP - 19.50 lb/ft - NC50
10	5" DP - 25.60 lb/ft - NC50
11	5 1/2" DP - 21.90 lb/ft - FH
12	5 1/2" DP - 24.70 lb/ft - FH
13	6 5/8" DP - 25.20 lb/ft - FH
14	6 5/8" DP - 27.70 lb/ft - FH

Total length:
When switching ON the EPST system for the first time during a drilling process the existing pipe configuration **need** to be inputted. Start to fill in the lowest (connected to the BHA) pipe part and fill in the total length of the corresponding pipe by using the numerical keypad.

Drill pipe entry length:
Each time a connection has been made the length of the concerning drill pipe entry must be adjusted. This can be done by touching the "Length" field of the current drill pipe entry and fill in the right length or by means of the "+" button. If the "+" or "-" buttons are used to adjust the drill pipe entry length, the right actual "One pipe stand" length must be set up correctly. This can be done by touching the "one stand" field in the current drill pipe entry row.
If applicable a new drill pipe entry must be added by selecting a pipe name at the next not used drill pipe entry row.

The "+" and "-" buttons is a tool to adjust easily a drill pipe entry length each time a stand is added. The mean length of the used stands must therefore be filled in the "One stand" length field.

Calculate:
If the settings of the BHA have been altered at the BHA entry or the settings of the drill pipe have been changed the **"calculate"** button starts **blinking.** This indicates that a calculation of the Kf and Cf values has to be made. Just press the **"calculate"** button to recalculate the Kf and Cf values.

Transfer:
If the calculated values differ from the current values of Kf and Cf, the **"transfer"** button starts blinking. Press the **transfer** button to copy the calculated values to the current (active) values of Kf and Cf.

IMPORTANT

Soft Torque must be in the off state before changing the Kf and Cf parameters.

Wrong settings can cause instability of the system.

The current values of Kf and Cf on this screen are the same values showed on the home screen.

5.5.1. Procedure for Kf and Cf calculations

See also paragraph 5.4 and 5.5.

New configuration:

1. Select Home screen
2. Switch ST OFF
3. Select BHA Entry screen
4. Fill in BHA settings at the BHA entry. See chapter 5.4
5. Select Drill Pipe Entry screen
6. Fill in (existing) Drill pipe settings at the Drill Pipe entry. See chapter 5.5
7. Press calculate button
8. Press transfer button
9. Select Home screen
10. Switch ST ON

Connecting new stand:

1. Select Home screen
2. Switch ST OFF
3. Select Drill Pipe Entry screen
4. If applicable a new drill pipe entry must be added by selecting a pipe name at the next not used drill pipe entry row
5. If necessary adjust length of one stand by using numerical keypad
6. Press “+” button or adjust the length field to add a stand length to the drill pipe entry with the highest number.
7. Press “**Calculate”** button to calculate new Cf, Kf and length values.
8. Press **“Transfer”** button to make new calculated values active.
9. Select Home screen
10. Switch ST ON

5.6. Messages screen

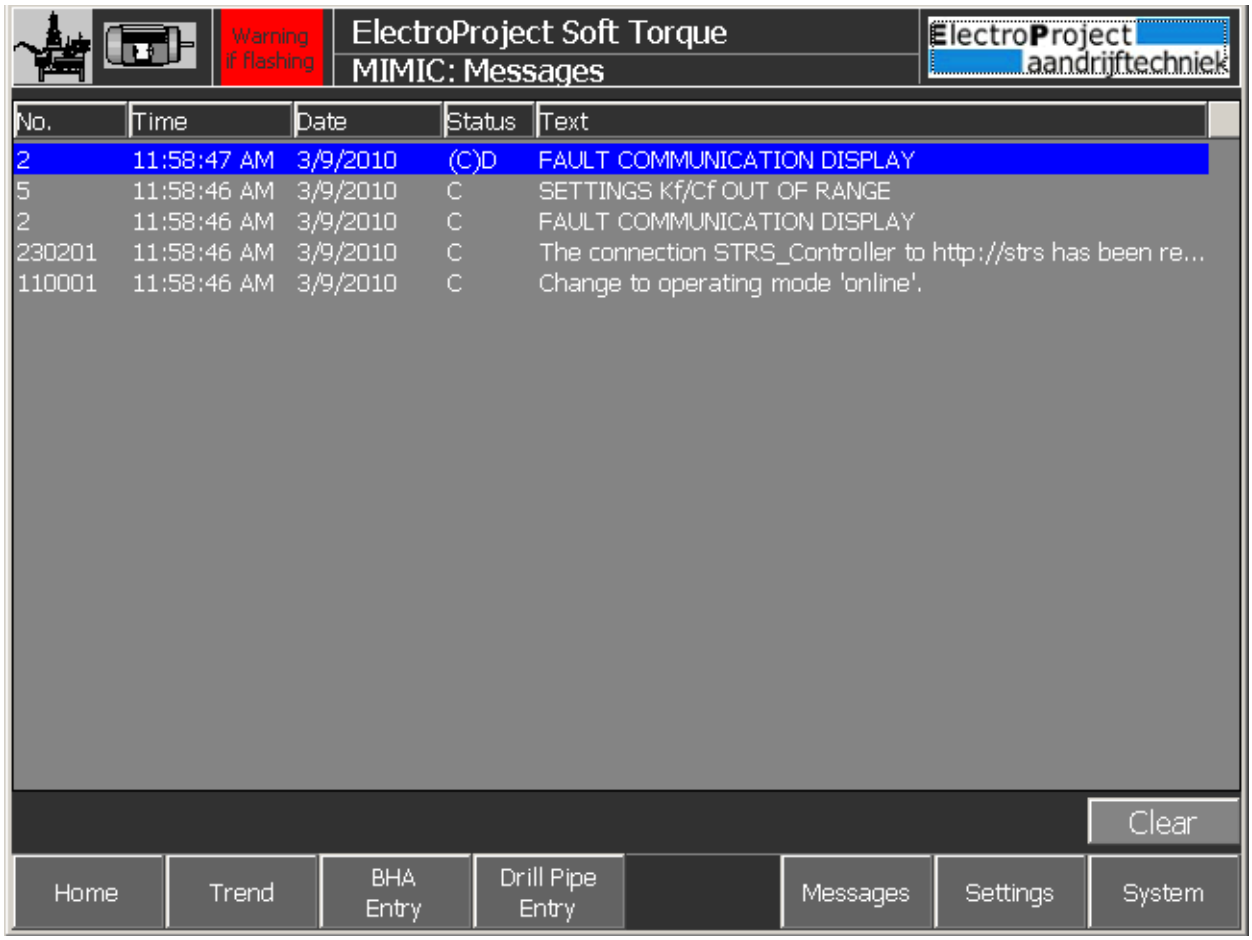


Figure 14: Messages screen

On the messages screen system messages are displayed. There are four EPST-system messages (see chapter 6.3).
On the messages screen also panel specific messages are displayed (e.g. communication, system diagnostic). An explanation of panel specific messages will not be explained in this manual and can be found in “Simatic Wincc” manuals. http://support.automation.siemens.com/WW/view/en/23337820

Pressing the clear button clears the list of system messages.

5.7. User Settings screen

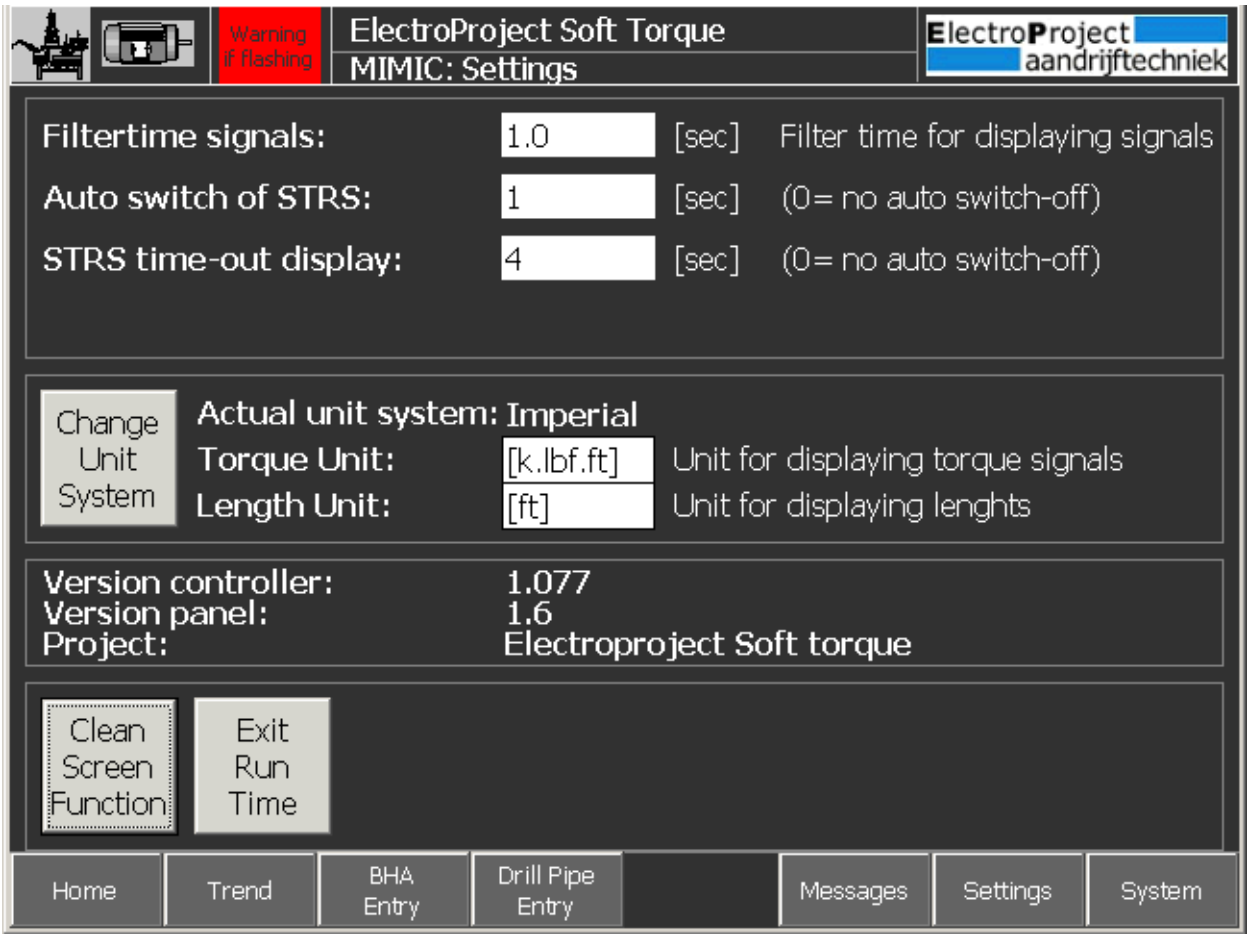


Figure 15: Settings screen

Filter time signals:

Filter time for displaying torque and speed signals.
To avoid aliasing of the displayed signals (especially in trends) a filter time greater than 0.5 seconds must be entered. To read out a mean value over a longer time, this setting can be set to a higher value.

Auto switch OFF:

If actual speed set point is in reversed direction or when the TD is switched off, ST will be switch off automatically after the “Auto switch of” time. This function can be disabled by entering 0 seconds.

WARNING
Soft Torque must be in the off state before changing the Kf and Cf parameters or when not in rotary drilling operation. Always check if ST is switched OFF when there is no rotary drilling operation.

EPST time-out display:

If there is no communication between the control touch panel and the EPST-IPC, ST will switch OFF after the “EPST time-out display” time. This function can be disabled by entering 0 seconds (only disable when there are communication problems and ST must be forced).

IMPORTANT
Note: This time should always be a minimum of 4 seconds.

Change Unit system:

Change over between [kNm]/[meter] and [k.lbf.ft]/[ft] units.

Clean Screen Function:

The screen will be blanked for 30 seconds to make it possible to wipe the screen clean without accidently pressing buttons or changing values.

Exit runtime:

If pressed, the running EPST control program will be shut down and the panel will return to its operating system (Windows CE). Settings of the touch panel it self can than be made.

WARNING
Be careful with the “Exit to runtime” function! When the EPST control program is terminated, ST will be switched OFF after the “EPST time-out display” setting! Also changing settings of the panel itself (e.g. network settings) can cause a malfunction of the EPST control panel!

5.8. System screen

This screen is for EPST specialists and will therefore not be described in this manual. A password is required.

6. Maintenance

6.1. Trouble shooting guide EPST system

Fault	Cause	Counter measure
VFD trip (F082)	One of the 2 Communication board profibus (CBP) fails.	- Power ON IPC? - Check profibus status lower slot card in VFD, all 3 Led's should flash. - Check measure screen on IPC
No value (#####) on touch panel (HMI) drillers cabin	Communication failure between IPC(switch) and HMI	- Power ON IPC? - Check cat5 cable - Check message screen on IPC - Check message screen on HMI
HMI not working	Power supply missing	check power supply and correct voltage for HMI
ST switches off sometimes	Communication lost with IPC for more than 4 seconds	- Check cable connectors CAT5 - Check routing of CAT5 cable, avoid noisy routing near noisy cables (power/motor cables)

6.2. Procedure: Disabling the EPST system

The EPST system can be disconnected from the VFD, after which the VFD can be operated normally without soft torque feature. The following procedure will fully disable the EPST system:

1. Make sure EPST is switched off on the EPST control panel.
2. Disconnect the purple cable (profibus) from the IPC.
3. The VFD drive will trip.
4. The VFD can be reset on the VFD panel (OP1S) with the reset button.
5. The VFD will continuously give Warning A91 (CB Alarm).
6. If not sure EPST was switched off when disconnecting profibus from VFD, restart the VFD by disconnecting 24V control power (operator panel of VFD will be blank).
7. After power on the drive will operate normally with this alarm on.

6.3. System Warnings

If the text "**Warning if flashing**" in the upper section of the screen is flashing an EPST system warning is active. By selecting the text "Warning if flashing" the warning screen will be opened. Here can be seen which EPST-warning is active:

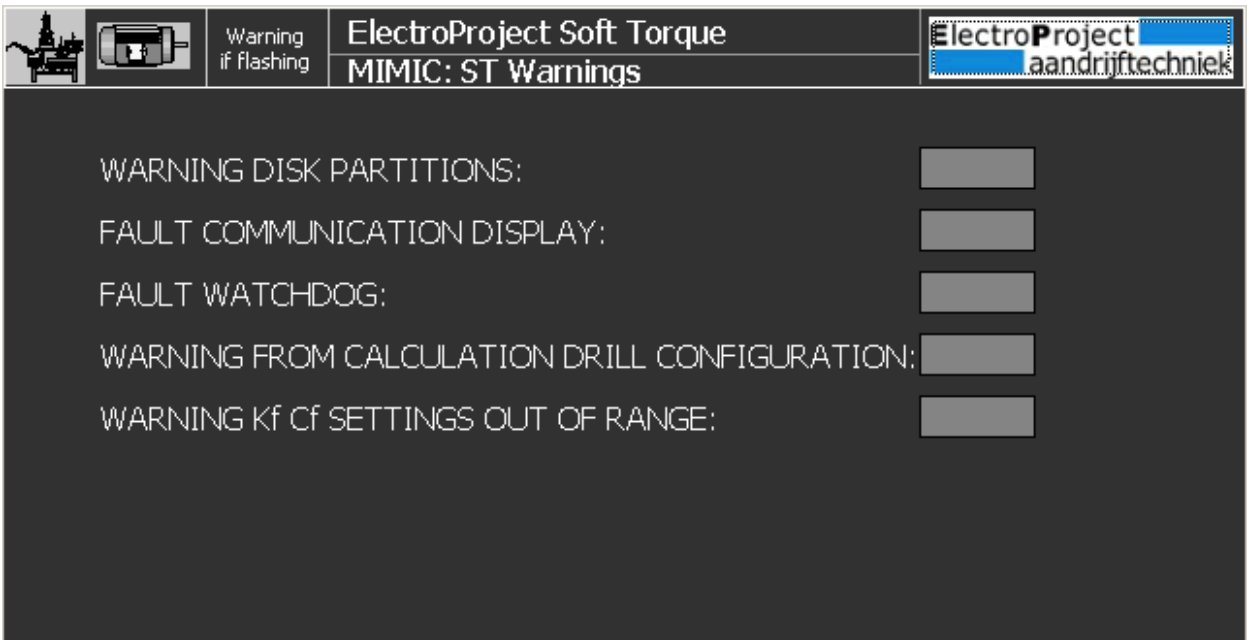


Figure 16: ST Warnings

1. Warning Disk Partitions

   If the EPST-IPC is supplied with two mirrored hard disks and one of the two gives a problem the gray box after the warning will flash. The system can still be operated normally, but if a second hard disk fails, the system can not work properly. Send the EPST-IPC for repair and place if available a spare EPST-IPC.

2. Fault Communication Display

   When flashing, a communication timeout between the control panel and the IPC is active. Check "EPST time-out display" settings in settings screen chapter 5.7 or check wiring.

3. Fault watchdog

   No profibus communication between EPST-IPC and VFD. Check if VFD is powered up or check wiring.

4. Warning from Calculation

   Calculation of drill string configuration can not be executed (check BHA and drill string configuration).

5. Warning Kf/Cf Settings out of range

   If Kf or Cf value is to high or to low an out of range error will be generated. Check if Kf and/or Cf values are correct inputted.

7. Annex

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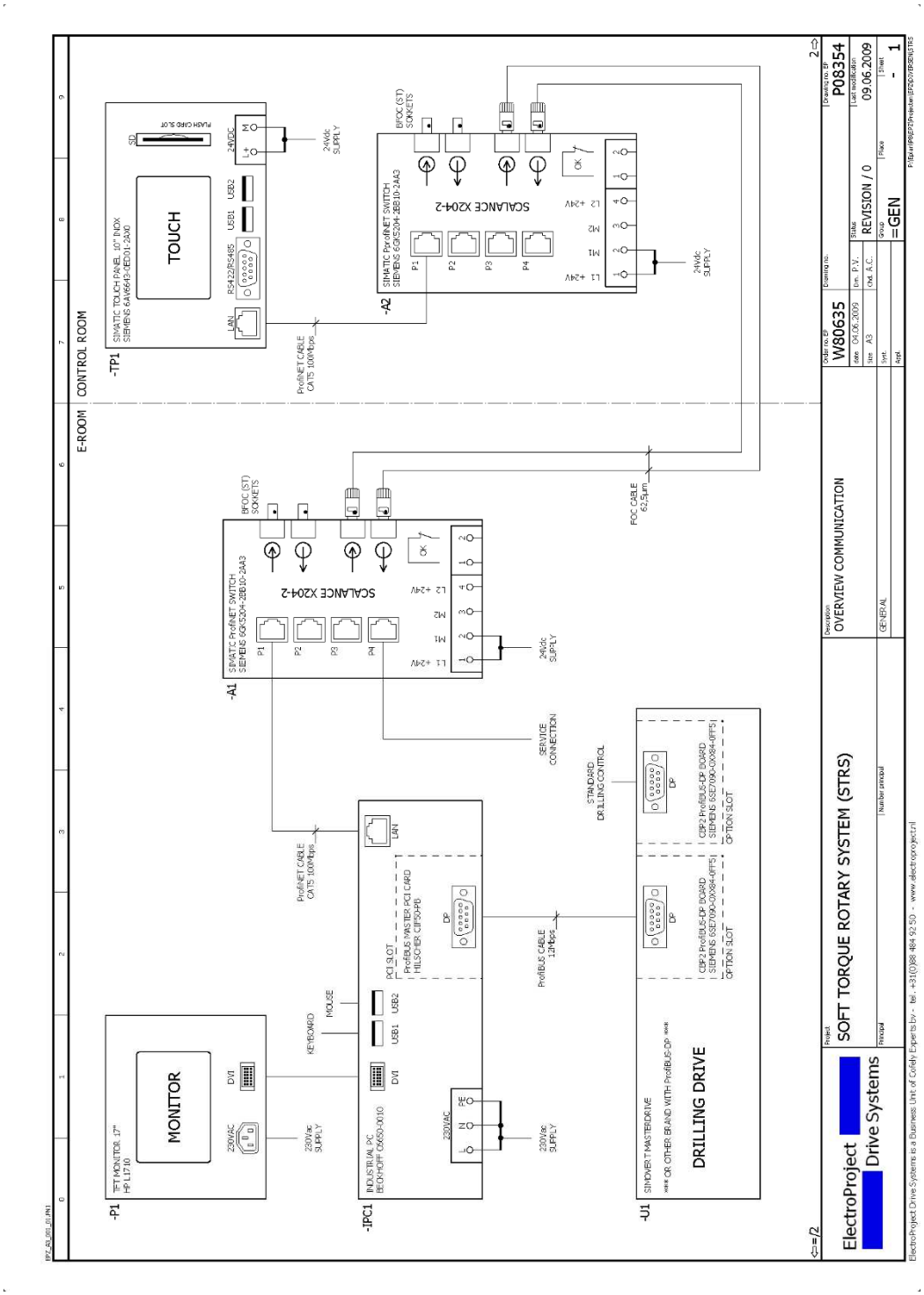
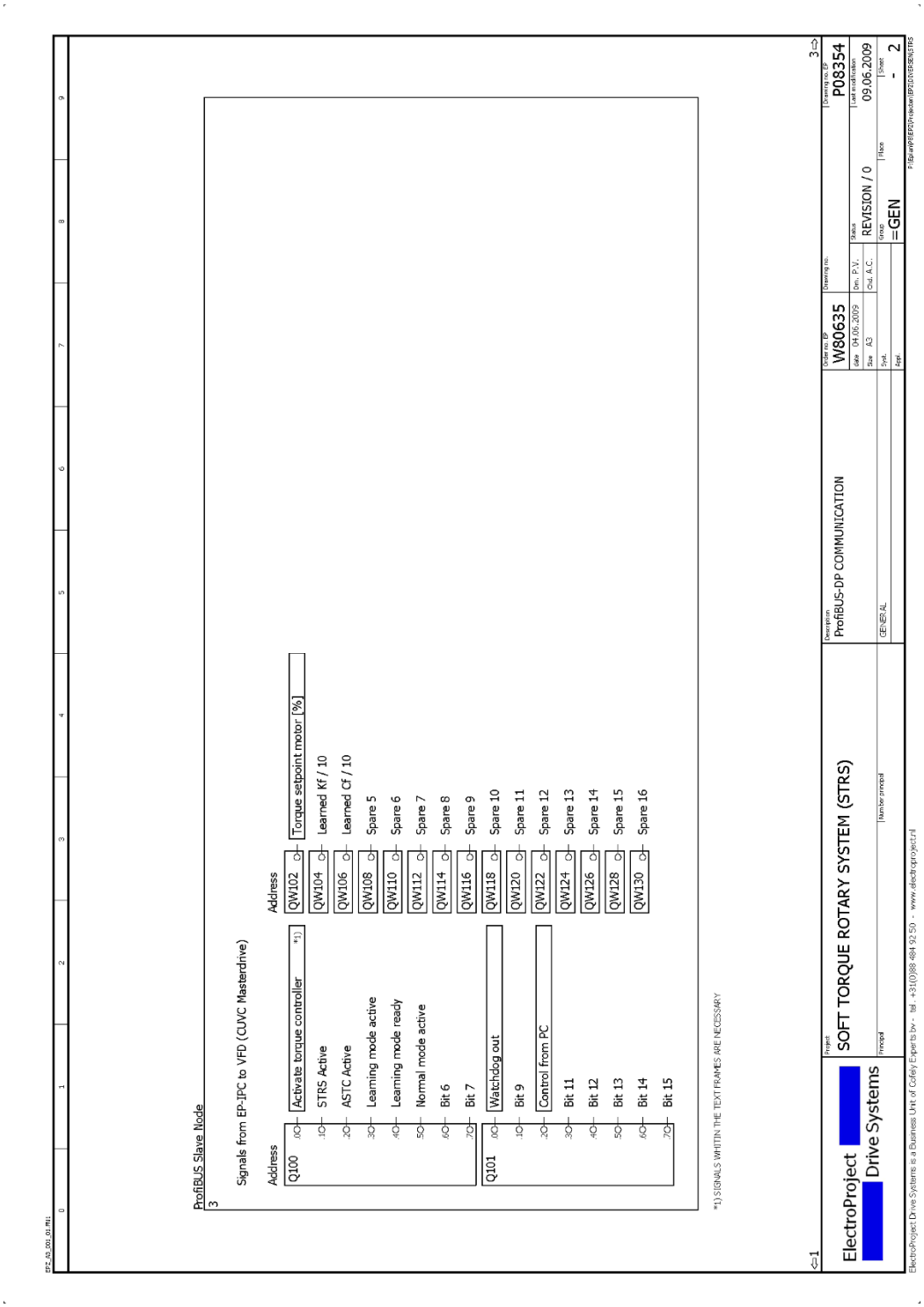
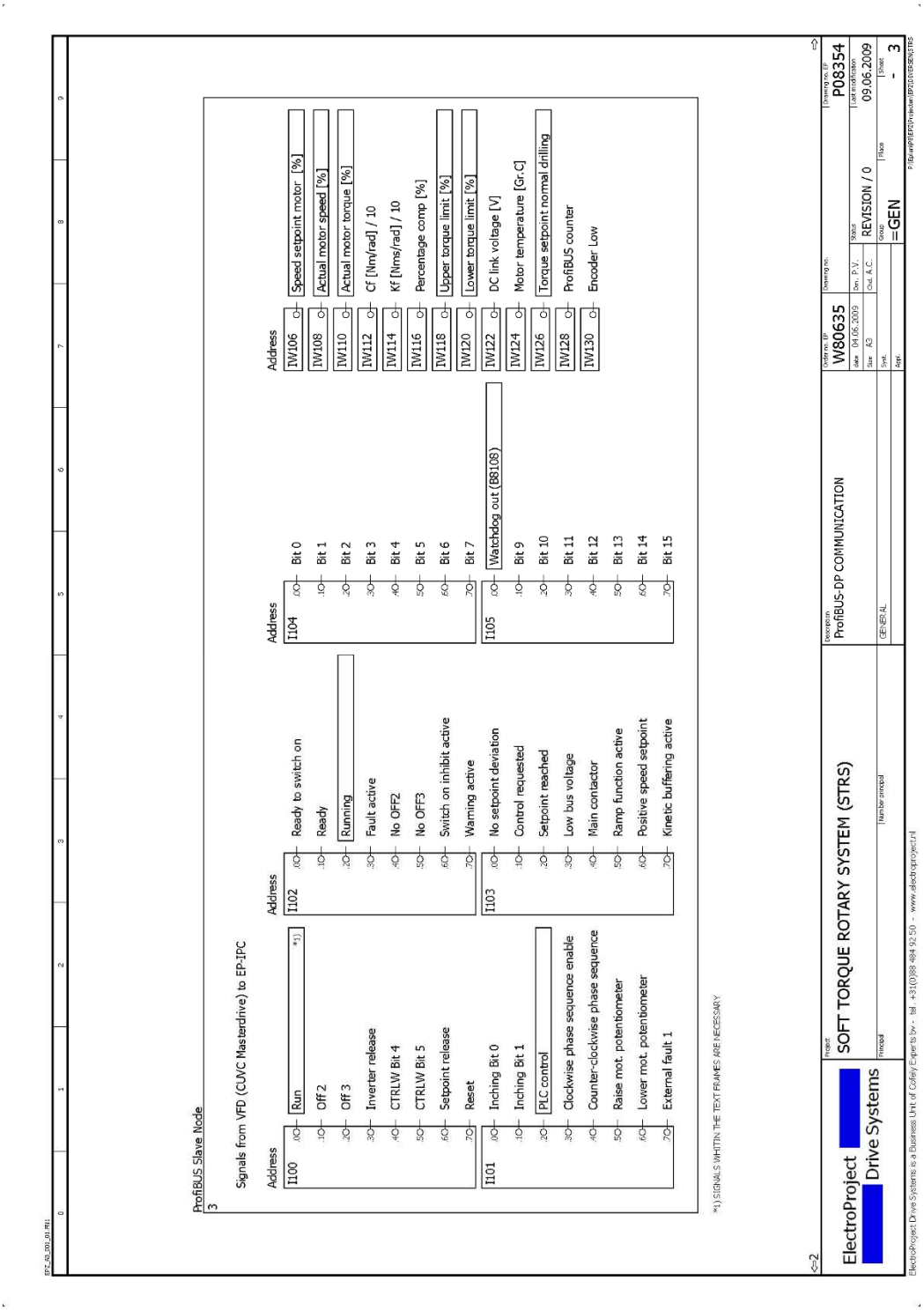
7.1. Overview installation



7.2. Communication layout between EPST-Server and VFD page 1



7.3. Communication layout between EPST-Server and VFD page 2



7.4. Quick Guide manual input Kf and Cf

EP soft torque controller
Quick guide manual input Kf and Cf

EPST ON/OFF

Only switch ON EPST in drilling operation mode
Switch OFF EPST before drilling will stop.
For instance in case of adding new stand

ON/OFF can be done by touching the screen button in the "Home screen"

Blinking Orange = OFF
Green = ON

Warning: IF EPST is ON while adding a stand TD can move!

CHANGE Kf and Cf

Kf or Cf values must be adjusted during drilling according to the drill depth!

Check if Kf or Cf values according to the drill depth are corresponding as listed in the Kf or Cf data sheet.

Entering the right settings must be done on the "Home" screen of the touch panel by touching Kf or Cf value fields.

Select Kf or Cf value; enter correct value by using numerical keyboard on screen. Enter "↵" to save new value.

NOTE: Preferably change Kf value first